

Status and Plans for the Los Alamos Sea Ice Model

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Many improvements have been made to CICE, the Los Alamos sea ice model, in the past year and a half, including upgrades to the thermodynamics, thickness distribution and ridging, dynamics, and other physical parameterizations in the model. Details are presented in our *CICE poster*. Many of these improvements came about as a result of our close collaboration with the CCSM Polar Climate Working Group at NCAR. We have been using the MPDATA scheme for horizontal advection for many years, but with the inclusion of a full ice thickness distribution in the model, advection is now the slowest component. Because of this, we are currently implementing and testing an incremental remapping method for horizontal advection. We are also updating the documentation and will soon release this code. Concurrently, researchers at Argonne National Laboratory are using automatic differentiation techniques to test sensitivities of the model parameters.

Our plans for further improvements to the sea ice model fall into two broad categories, software and physics. The software improvements include a hybrid MPI/OpenMP cache-blocked decomposition for performance, and we plan to investigate the Multi-Level Parallelism method which takes advantage of shared memory on machines like the SGI. We will make the tri-pole grid an option in CICE, and we plan to conform to the Earth System Model Framework that is currently being formulated. We would also like to improve some of the physics parameterizations, including percolation and snow-ice formation, ice ridging and ridge decay, melt ponds, granular flow dynamics, and ice biogeochemistry.

Our plans also include coupling; CICE is being coupled with both POP and MICOM at Los Alamos. In particular, there has been an effort to compare POP and MICOM using simple parameterizations for the ice cover, but now the comparison will include coupling with the full ice model. As part of our model development and evaluation program at Los Alamos, we will be studying polar processes in the coupled models, and we are planning, with scientists from NCAR, to submit POP coupled with CICE to the Arctic Ocean Model Intercomparison Project (AOMIP). A collaborative project with the University of California at Santa Cruz will investigate the effect of ice shelves and sea ice on the thermohaline circulation, and we hope to begin a global ice-ocean simulation at very high resolution, 0.1 deg, in the near future.